



Answer The Following Questions

(ملحوظة هامة: الأسئلة في ورقتين)

The First Question

(a) What is wrong with the following register transfer statements:

- 1. $xT: AR \leftarrow AR', AR \leftarrow 0$
- 2. $yT: R_1 \leftarrow R_2, R_1 \leftarrow R_3$
- 3. $zT: PC \leftarrow AR, PC \leftarrow PC + 1$

(b) Design an arithmetic circuit with one selection variable S and two n-bit data inputs A and B. The circuit generates the following four arithmetic operations in conjunction with the input carry C_{in} . Draw the logic diagram for the first two stages.

S	$C_{in} = 0$	$C_{in} = 1$
0	$D = A + B$ (add)	$D = A + 1$ (increment)
1	$D = A - 1$ (decrement)	$D = A + \bar{B} + 1$ (subtract)

(c) The 8-bit registers AR, BR, CR, and DR initially have the following values:

$$AR = 11110010, BR = 111111, CR = 10111001, DR = 11101010.$$

Determine the 8-bit values in each register after the execution of the following sequence of microoperations.

$$AR \leftarrow AR + BR$$

Add BR to AR

$$CR \leftarrow CR \wedge DR, BR \leftarrow BR + 1$$

AND DR to CR, increment BR

$$AR \leftarrow AR - CR$$

Subtract CR from AR

The Second Question

(a) What is the difference between a direct and an indirect address instruction? How many references to memory are needed for each type of instruction to bring an operand into a processor register?

(b) A computer uses a memory unit with 256K words of 32 bits each. A binary instruction code is stored in one word of memory. The instruction has four parts: an indirect bit, an operation code, a register code part to specify one of 64 registers, and an address part.

- 1. How many bits are there in the operation code, the register code part, and the address part?
- 2. Draw the instruction word format and indicate the number of bits in each part.
- 3. How many bits are there in the data and address inputs of the memory?

(c) A computer uses a memory of 65,536 words with eight bits in each word. It has the following registers: PC, AR, TR (16 bits each), and AC, DR, IR (eight bits each). A memory-reference instruction consists of three words: an 8-bit operation-code (one

word) and a 16-bit address (in the next two words). All operands are eight bits. There is no indirect bit.

1. Draw a block diagram of the computer showing the memory and registers.
2. Draw a diagram showing the placement in memory of a typical three-word instruction and the corresponding 8-bit operand.
3. List the sequence of microoperations for fetching a memory reference instruction and then placing the operand in DR. Start from timing signal T_0 .

The Third Question

(a) How many times does the control unit refer to memory when it fetches and executes an indirect addressing mode instruction if the instruction is

1. A computational type requiring an operand from memory;
2. A branch type

(b) Convert the following numerical arithmetic expression into reverse Polish notation and show the stack operations for evaluating the numerical results.

$$(3 + 4)[10(2 + 6) + 8]$$

(c) An instruction is stored at location 300 with its address field at location 301. The address field has the value 400. A processor register R1 contains the number 200. Evaluate the effective address if the addressing mode of the instruction is (a) direct; (b) immediate; (c) relative; (d) register indirect (e) index with R1 as the index register.

The Fourth Question

(a) What is the purpose of the IP/EIP register?

(b) Find the memory address of the next instruction executed by the microprocessor, when operated in the real mode, for the following CS:IP combinations:

1. CS = 1000H and IP = 2000H
2. CS = 2000H and IP = 1000H

(c) Protected mode memory addressing allows access to which area of the memory in:

- 1- The 80286 microprocessor
- 2- The Pentium II microprocessor.

With my best wishes